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(54) Locking mechanism for a multi-disc player

(57) A disc recording/reproducing apparatus includes a recording/ reproducing section, a disc tray 2, a driving mechanism, a rotary table 3, a lock mechanism for the disc tray and a suppression mechanism. The recording/reproducing mechanism is provided in a main body of the apparatus for recording/reproducing information signals on or from the disc. The disc tray 2 may be moved between a position facing the recording/reproducing section in the main body of the apparatus and an unloading position outside of the main body of the apparatus. The driving mechanism causes the disc tray to be moved between the loading position and the unloading position. The rotary table 3 is rotatable mounted on the disc tray and has plural disc-setting sections 53, 54 extending radially from the center of rotation. The rotary table 3 is rotated relative to the disc tray for selectively locating one of the plural disc setting sections at a position of facing the recording/reproducing section. The lock mechanism of the rotary table obstructs the rotation of the rotary table when the disc tray is not located at the loading position or at the unloading position. The lock mechanism also is actuated by the driving mechanism in order to obstruct the movement of the disc tray and is similarly driven by the driving mechanism when the disc tray reaches the unloading position in order to obstruct the movement of the disc tray. The suppression mechanism inhibits oscillatory movements of the disc tray at the loading or unloading position of the disc tray.

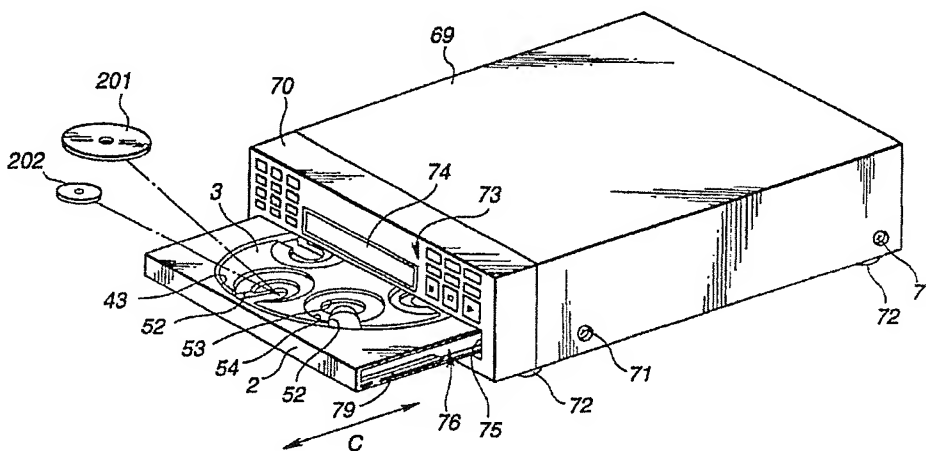


FIG. 1

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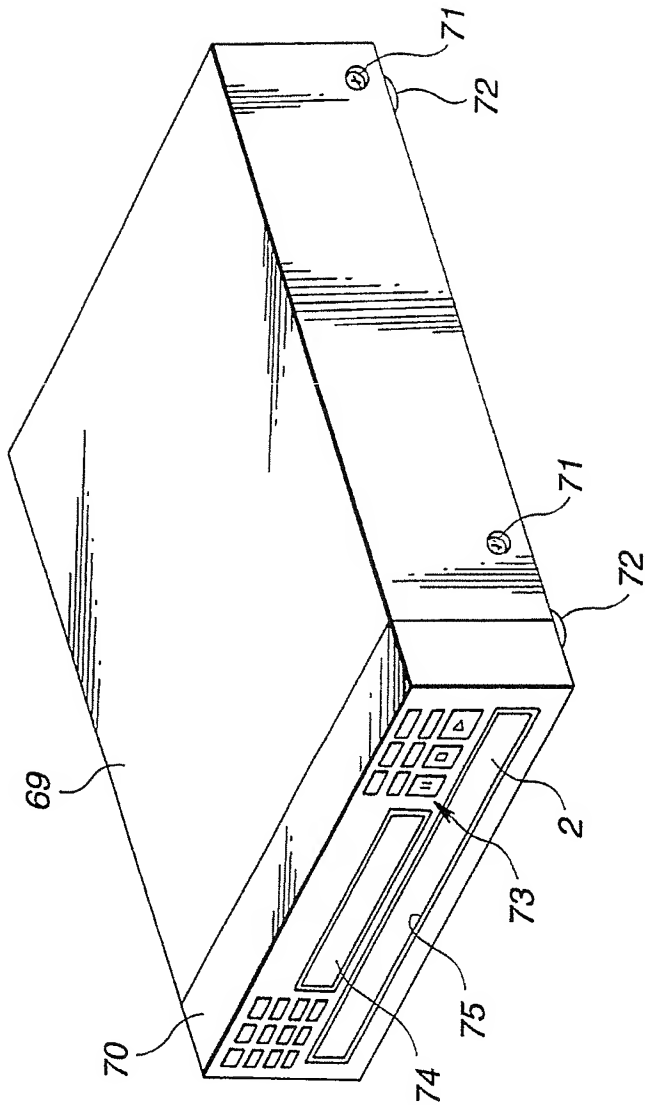


FIG. 2

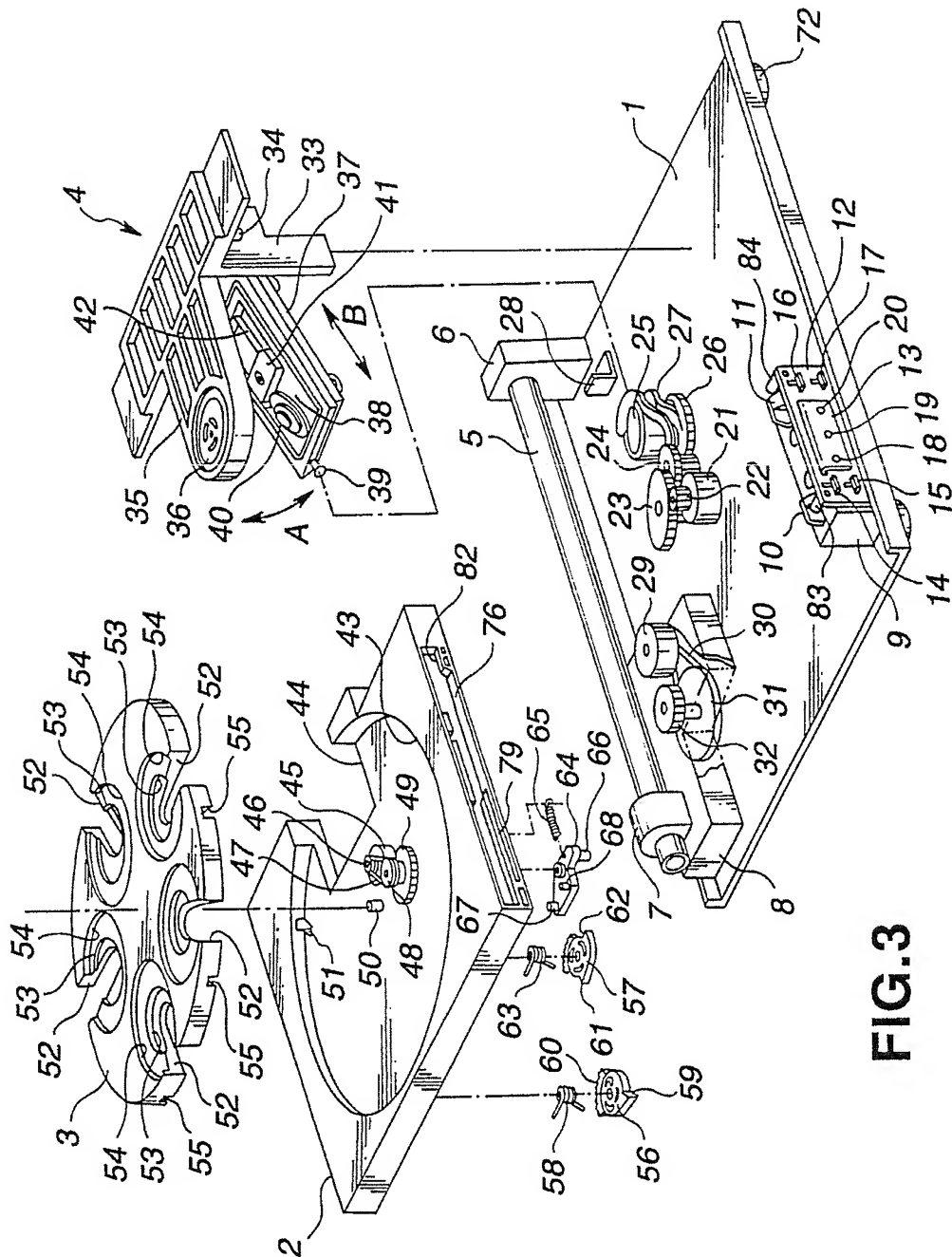


FIG.3

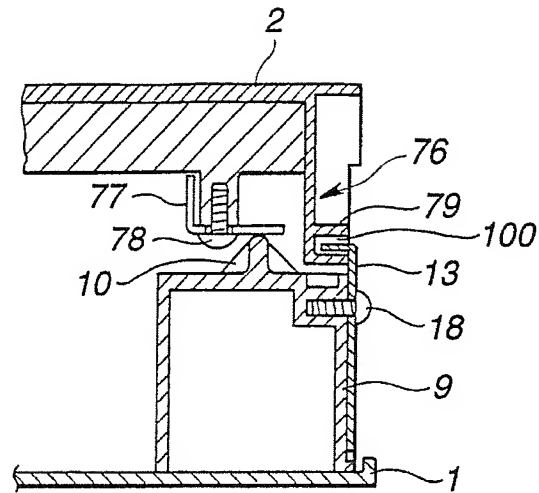


FIG. 4

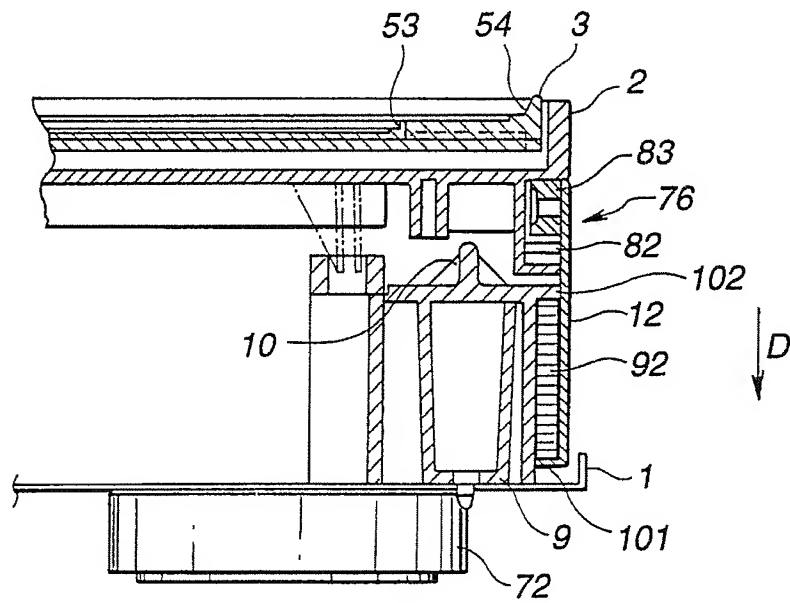


FIG. 5

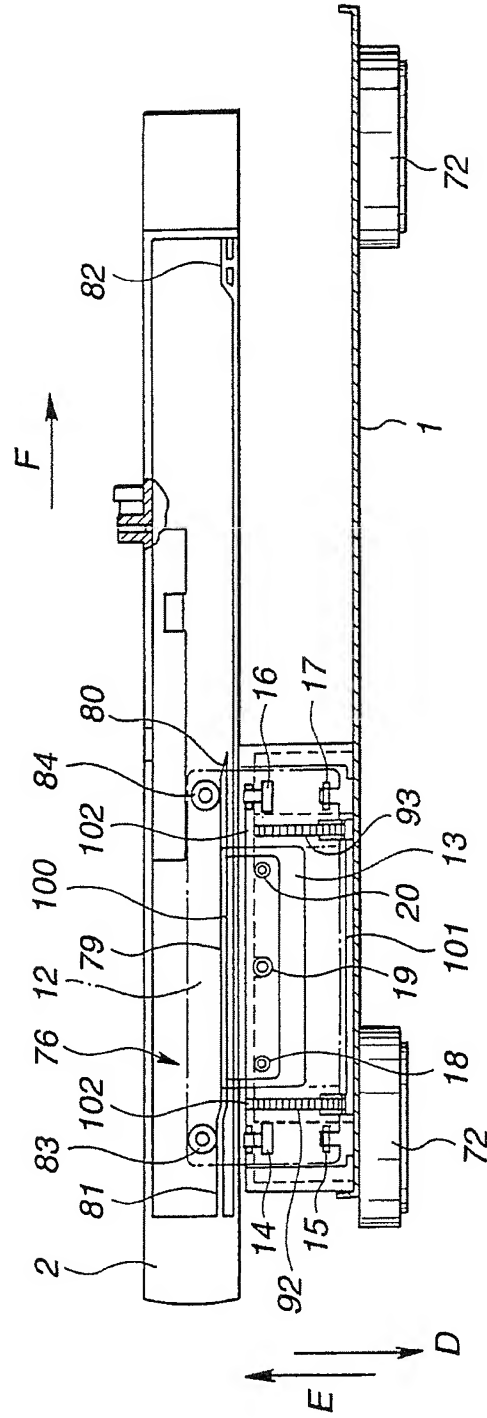


FIG. 6

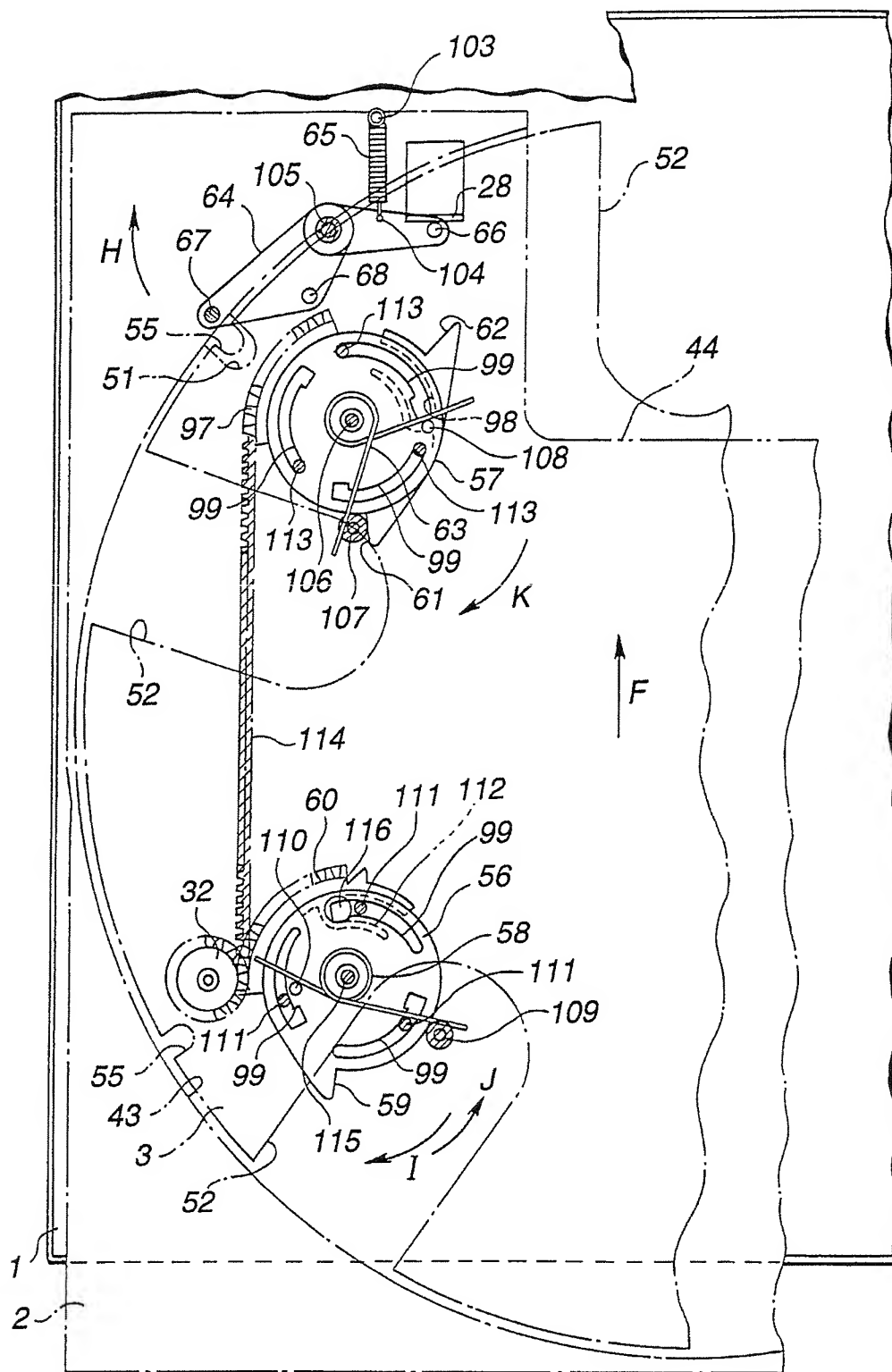


FIG.9

FIG.10

FIG.11

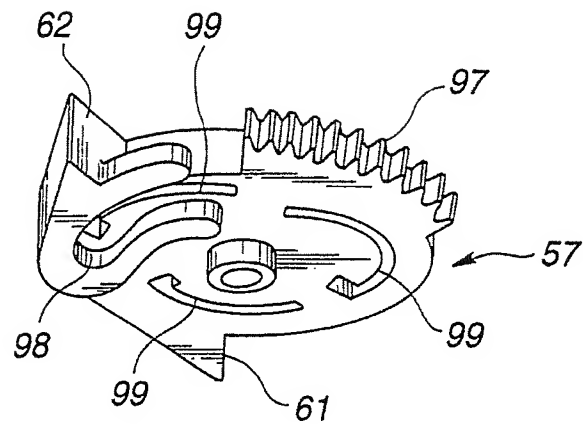


FIG. 12

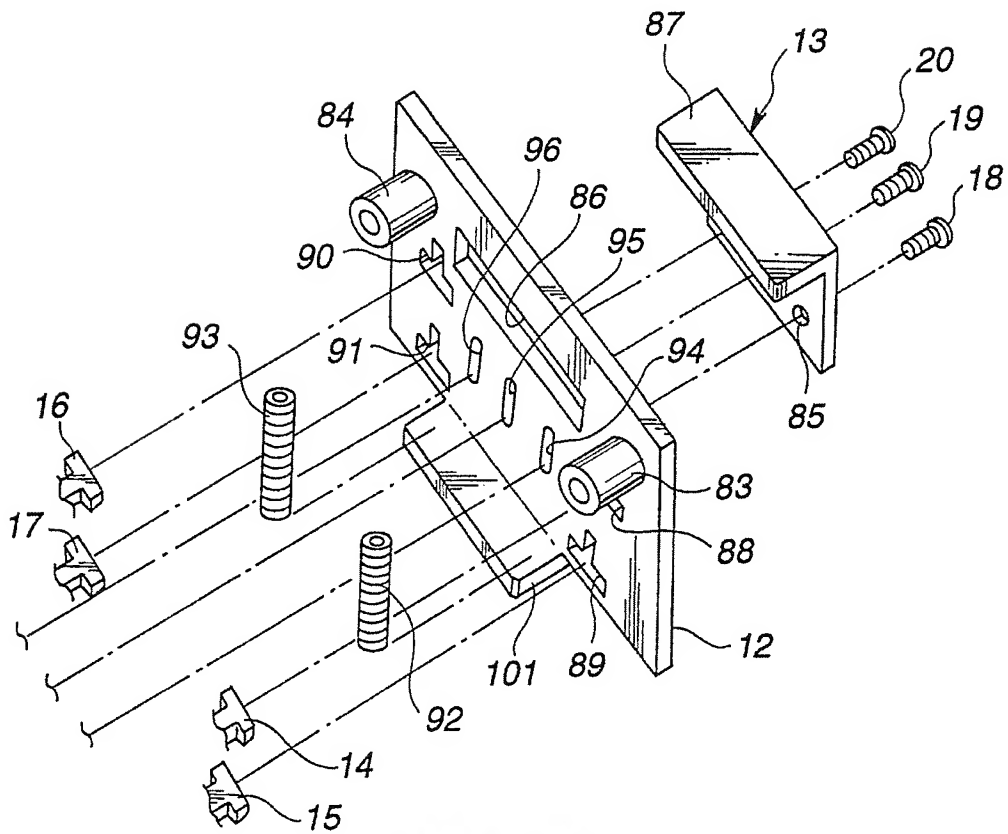


FIG. 13

DISC RECORDING AND/OR REPRODUCING APPARATUS

The invention relates to a disc recording and/or reproducing apparatus. More particularly, the present
5 invention relates to a transporting mechanism for the disc recording and/or reproducing apparatus.

There has hitherto been proposed a disc recording and/or reproducing apparatus in which information signals are recorded on and/or reproduced from a recording disc, as
10 a recording medium, such as an optical disc or a magneto-optical disc.

The disc recording and/or reproducing apparatus includes a rotation mechanism for holding and rotating the recording disc and a pickup unit for writing/reading the
15 information signals on or from the recording disc run in rotation by the rotation mechanism.

The disc recording and/or reproducing apparatus also includes a disc tray adapted to transport a recording disc set thereon between the outer side and the inner side
20 of a main body of the apparatus. The disc tray is supported on a supporting shaft arranged on a chassis of the recording and/or reproducing apparatus. The disc tray is movable along the supporting shaft between an unloading position of being protruded from the main body of the apparatus and a
25 loading position of substantially facing a disc driving unit within the main body of the apparatus on the chassis. The disc tray is movable by a driving mechanism, such as an electric motor. The disc tray on which the recording disc is set and which has been moved to the loading position has
30 reached the position in which the recording disc is in register with the disc driving unit. The recording disc positioned in register with the disc driving unit is loaded on the driving unit. Thus the recording disc is held by the rotation mechanism and thereby run in rotation for

recording/reproducing the information signals by an optical pickup unit.

Among the disc recording and/or reproducing apparatus having a rotary table, there is such an apparatus in which a selected one of plural recording discs is taken out for recording/reproduction by the disc driving unit. As this type of the disc recording and/or reproducing apparatus, such an apparatus is proposed in which a disc tray carries a rotary table on which plural recording discs are set in parallel, as disclosed for example in US Patent Nos. 4,755,978 and 5,123,005. The rotary table is substantially disc-shaped and rotatable supported relative to the disc tray. The upper surface of the rotary table is formed with plural disc-setting recesses arrayed on the circumference of a circle having the center of rotation of the rotary table as its center. These disc-setting trays are arrayed at an equiangular distance about the center of rotation of the rotary table. The rotary table is rotated relative to the disc tray by a driving mechanism, such as an electric motor, mounted on the disc tray.

When the disc tray is at the loading position, the rotary table is rotated relative to the disc tray for selectively moving one of the recording discs set thereon to a position in register with the disc drive unit.

In one disc recording and/or reproducing apparatus having a rotary table, when a recording disc was set on the disc drive unit, the disc tray may be moved to an unloading position. With this type of the disc recording and/or reproducing apparatus, when a recording disc set in one of the disc setting recesses has been loaded on the disc drive unit, the disc tray is moved to the unloading position for setting other recording discs on other disc setting recesses or exchanging the discs set in such other disc setting recesses. Therefore, with such disc recording and/or reproducing apparatus, the information signals may be

continuously recorded on and/or reproduced from a number of the recording discs larger than the number of the disc setting recesses formed on the rotary table. If, with the disc recording and/or reproducing apparatus in which the disc tray is designed to be moved to the unloading position during loading of the recording disc on the disc drive unit, the disc tray is moved to the unloading position when a recording disc has been set on the disc drive unit, the disc tray is drive-controlled so that it may again be moved to the loading position on the proviso that the rotational angular position of the rotary table when the disc tray was at the loading position is maintained and that there is no other recording disc set on the disc setting recess on which the recording disc loaded on the disc drive unit was set.

With the above-described disc recording and/or reproducing apparatus, having the disc tray, there is a risk that, if the recording disc is rotated during the time the disc tray is at the loading position, the disc tray is oscillated with respect to the chassis in resonance with the oscillations caused with the rotation of the recording disc. Such resonant oscillations tend to produce abnormal sounds or obstruct the normal recording/reproducing operation of the pickup unit.

In another conventional disc recording and/or reproducing apparatus, is provided with a holding mechanism for holding the disc tray in association with the operation of holding of the recording disc by the disc driving unit for suppressing the oscillation of the disc tray. Such holding mechanism complicates the structure and renders it difficult to simplify the construction and reduce the size of the disc recording and/or reproducing apparatus in its entirety.

Also, with the disc recording and/or reproducing apparatus which is provided with the rotary table and in which the disc tray may be moved to the unloading position

when a recording disc was loaded on the disc drive unit, the disc tray which is set to the unloading position during the rotation of the recording disc tends to be oscillated in resonance with the oscillations caused with the recording
5 disc rotation.

The apparatus may apply a pre-loading force thrusting the disc tray at all time against the supporting shaft is applied to the disc tray for suppressing the resonant oscillations of the disc tray. Such pre-loading
10 force tends to increase the load against the movement of the disc tray along the supporting shaft and the sliding noise between the disc tray and the supporting shaft and to enlarge the size of the drive mechanism.

On the other hand, with the disc recording and/or reproducing apparatus which is provided with a rotary table and in which the disc tray may be moved to the unloading position when a recording disc was set on the disc drive unit, the rotary table tends to be rotated under an external
15 pressure.

Above all, since the control for the driving mechanism is not in operation during power off, the rotary table may be rotated under external pressure. If the recording disc is set on the rotary table, it is possible for the disc tray to be rotated back to the loading position
20 under the external pressure even in cases where a recording disc is loaded on the disc drive unit and another recording disc is set in the disc setting recess positioned in register with the disc drive unit. In such a case, there is a risk that the recording disc loaded on the disc drive unit
25 and the other disc set on the rotary table may collide against each other causing damage to, or destruction of, the discs.
30

It is therefore an object of the present invention to provide a disc recording and/or reproducing apparatus
35 which resolves the above-mentioned problems.

According to the present invention, there is provided a disc recording and/or reproducing apparatus comprising:

5 recording/reproducing means for recording/reproducing information signals on or from a disc mounted in a main body of the apparatus;

a transporting tray mounted for movement between a loading position facing said recording/reproducing means provided within said main body of the apparatus and an
10 unloading position outside of said main body of the apparatus;

driving means for moving said transporting tray between the loading position and the unloading position;

a rotary table rotatable mounted on said
15 transporting tray, said rotary table having plural disc-setting recesses extending radially from the center of rotation thereof, said rotary table when rotated relative to said transporting tray selectively moving one of said disc setting recesses to a position facing said
20 recording/reproducing means;

first lock means provided on said transporting tray and adapted for being engaged with said rotary table for obstructing the rotation of said rotary table with respect to said transporting tray, said first lock means
25 obstructing the rotation of the rotary table when said transporting tray is not positioned at said unloading position; and

second lock means operated by said driving means for obstructing the movement of said transporting tray, said
30 second lock means being actuated by said driving means for obstructing the movement of said transporting tray when the transporting tray reaches said unloading position.

The present invention also provides a disc recording and/or reproducing apparatus comprising:

recording/reproducing means for
recording/reproducing information signals on or from a disc
mounted in a main body of the apparatus;

5 a transporting tray mounted for movement between a
loading position facing said recording/reproducing means
provided within said main body of the apparatus and an
unloading position outside of said main body of the
apparatus;

10 driving means for moving said transporting tray
between the loading position and the unloading position; and
suppression means for inhibiting oscillations of
said transporting tray at said loading position or at said
unloading position.

15 The present invention thus provides a disc
recording and/or reproducing apparatus whereby resonant
oscillations of the transporting tray at the loading
position or at the unloading position may be inhibited
without complicating the structure and rotation of the
rotary table may be inhibited during movement of the
20 transporting tray.

Since the movement of the transporting tray is
suppressed by the second lock mechanism driven by the
driving mechanism at the loading position or at the
unloading position, the tray is not moved inadvertently into
25 the inside of the main body when the tray is at the
unloading position. Besides, since rotation of the rotary
table is suppressed during loading of the transporting tray
by the first lock mechanism, it is not rotated during
loading nor rotated inadvertently during power down of the
30 apparatus.

Since the oscillatory movement of the transporting
tray is suppressed by the suppression mechanism at the
loading position and at the unloading position, the
transporting tray is not oscillated in resonance with
35 rotation of the disc caused by the recording/reproducing

apparatus. Furthermore, according to the present invention, the transporting tray may be moved without loading the driving mechanism for the transporting tray by the mechanism of suppressing the resonation of the transporting tray.

5 The invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which:-

 Fig. 1 is a perspective view showing a disc recording and/or reproducing apparatus in a loading state
10 according to the present invention.

 Fig. 2 is a perspective view showing the disc recording and/or reproducing apparatus of Fig. 1 in a unloading state.

 Fig. 3 is an exploded perspective view showing
15 essential portions of the disc recording and/or reproducing apparatus shown in Fig. 1.

 Fig. 4 is an enlarged longitudinal sectional view showing a structure for supporting the disc tray in the disc recording and/or reproducing apparatus shown in Fig. 1.

20 Fig. 5 is an enlarged longitudinal sectional view showing a tray fastening structure in the disc recording and/or reproducing apparatus shown in Fig. 1

 Fig. 6 is a longitudinal sectional view showing the disc recording and/or reproducing apparatus of Fig. 1 in
25 a loading state.

 Fig. 7 is a longitudinal sectional view showing the disc recording and/or reproducing apparatus of Fig. 1 in an unloading state.

 Fig. 8 is a longitudinal sectional view showing
30 the disc recording and/or reproducing apparatus of Fig. 1 in an intermediate state between a loading state and an unloading state.

 Fig. 9 is an enlarged plan view showing the state of a disc tray and related components of the disc recording

and/or reproducing apparatus of Fig. 1 in the loading state.

Fig. 10 is an enlarged plan view showing the state of a disc tray and related components of the disc recording and/or reproducing apparatus of Fig. 1 in an intermediate state between a loading state and an unloading state.

Fig. 11 is an enlarged plan view showing the state of a disc tray and related components of the disc recording and/or reproducing apparatus of Fig. 1 in the unloading state.

Fig. 12 is an enlarged perspective view showing the shape of an interrupted gear in the disc recording and/or reproducing apparatus.

Fig. 13 is an enlarged exploded perspective view showing the structure of the tray fastening mechanism.

Referring to the drawings, preferred embodiments of the present invention will be explained in detail.

The disc recording and/or reproducing apparatus is designed to reproduce information signals from a number of recording discs, that is plural large-sized discs 201 and/or plural small-sized discs 202, loaded therein, as shown in Fig. 1. These discs 201, 202 are each comprised of a disc substrate formed of a transparent material, such as polycarbonate, and a reflective layer deposited on the disc substrate. On the disc substrate are formed patterns of small-sized protrusions and recesses corresponding to the information signals by injection molding or the like technique. The large-sized disc 201 and the small-sized discs 202 are of diameters of, for example, 12 cm and 8 cm, respectively. The large-sized discs 201 and the small-sized discs 202 are each formed with a chucking center hole having a diameter of, for example, 15 mm. The diameter of the chucking hole and the thickness of the disc substrate are the same for the large-sized disc 201 and the small-sized disc 202.

The disc recording and/or reproducing apparatus includes a chassis 1, as shown in Figs. 2 and 3. The chassis 1 is a substantially flat plate the lower side of which carries four insulators 72. An outer casing is constituted by the chassis 1, an upper cover 69 and a front panel 70. That is, the upper cover 69 is secured to the chassis 1 by set screws 71, 71 for constituting both sidewalls, a rear wall and a top plate of the outer casing. The front panel 70 has an actuating section 73, a display 74 and a slit aperture 75 for entrance and exit of a disc tray 2 as later explained, and constitutes the front wall of the outer casing.

The disc recording and/or reproducing apparatus also includes a control circuit, not shown. The control circuit is constituted by a CPU and the like and is responsive to actuation of the actuating section 73 and the results of detection by the disc detection device as later explained to control the motors and the optical pickup unit as later explained.

On the chassis 1 is mounted a disc drive unit 4 for reading out information signals from the discs 201 and 202. The disc drive unit 4 includes a support 33 mounted on the upper surface of the chassis 1 and a movable frame 37 rotatable supported on the upper surface of the chassis 1 via a supporting shaft 34. The support 33 includes a pair of posts and a top plate bridging the upper ends of these posts and cast integrally with the posts. The movable frame 37 is mounted between the posts.

On the movable frame 37, a pickup block 38 for suppressing transmission of oscillations from the frame 37 is mounted via a buffer, not shown. The optical pickup block 38 includes a spindle motor and an optical pickup unit 41. A disc table 40 is mounted on a driving shaft of the spindle motor. The disc table 40 is substantially circular in shape and carries tapered protrusions engaged in chucking

holes in the discs 201, 202. The optical pickup unit 41 is supported by a guide shaft 42 mounted on the pickup block 38 for movement in a direction towards and away from the disc table 40 indicated by arrow B in Fig. 3.

5 The top plate of the support 33 has an integrally formed arm section 35, the foremost part of which rotatable carries a chucking plate 36 disposed for facing the disc table 40.

10 The disc drive section 4, when mounted on the chassis 1, has its movable frame 37 positioned below the arm section 35, that is towards the chassis 1. The movable frame 37 may be rotated in a direction in which the disc table 40 is moved towards and away from the chucking plate 36 as shown by arrow A in Fig. 3. The disc table 40 has a
15 magnet, enclosed therein, for attracting the chucking plate 36, formed of iron, stainless steel or the like magnetic material, when the movable frame 37 is rotated towards the movable arm section 35.

20 The chassis 1 carries a chucking motor 21 adapted for rotating the movable frame 37. The chucking motor 21 rotates a cam tube 25 via speed-reducing gears 23, 24 rotatable mounted on the chassis 1 by a driving gear 22 mounted on a driving shaft. The cam tube 25 is
25 substantially cylindrical-shaped and rotatable mounted on the chassis 1. The cam tube 25 has a gear part 26 meshing with the speed-reducing gear 24 and a cam groove part 27 which is formed substantially spirally on the outer
30 peripheral surface of the cam tube 25. The cam groove part 27 is engaged by a profiling pin 39 protuberantly formed on the free end of the movable frame 37. When the chucking
35 motor 21 is driven in operation, the cam tube 25 is rotated so that the movable frame 37 is rotated about a pivot 34 between a chucking position of connecting the disc table 40 to the chucking plate 36 and a release position in which the disc table 40 is disengaged from the chucking plate 36.

It is possible for the disc drive unit 4 to clamp the center part of the large-sized disc 201 or the small-sized disc 202 between the disc table 40 and the chucking plate 36 in order to hold the disc in position with the chucking hole as reference. It is also possible for the disc drive unit 4 to rotate the disc 201 or 202 by the spindle motor. The optical pickup unit 41 may be moved across the inner and outer rims of the discs 201 or 202, thus driven in rotation, in order to read or record the information signals from or on the discs 201 or 202.

The disc tray 2, as a transporting tray, is movably mounted on the chassis 1. The disc tray 2 is a substantially flat plate mounted parallel to the chassis 1. The disc tray 2 has its one lateral side supported by a supporting shaft 5 arranged on one lateral side of the chassis 1, while having its opposite lateral side supported by a supporting block 9 arranged at a forward portion on the opposite lateral side of the chassis 1. Thus the disc tray 2 is movable in the fore-and-aft direction, that is in a direction along the length of the supporting shaft 5. The supporting shaft 5 has its forward end supported by a supporting portion 7 of a block 8 arranged at a forward portion on one lateral side of the chassis 1. The supporting shaft also has its rear end supported by a shaft supporting member 6 arranged at a rear portion on one lateral side on the chassis 1. On the upper surface of the supporting block 9 are protuberantly formed a pair of support lugs 10, 11, the distal ends of which are caused to support a rail 77 mounted on the lower surface of the disc tray 2. The rail 77 is secured to the disc tray 2 by a set screw 78.

On the chassis 1 is mounted a loading motor 29 as driving means. The loading motor 29 rotationally drives a follower pulley 31 and a loading gear 32 operatively connected to the follower pulley 31 via an endless driving

belt 30. The lower surface of the disc tray 2 carries a rack gear 114 meshing with the loading gear 32, as shown in Fig. 9. The rack gear 114 is formed for extending in the fore-and-aft direction of the disc tray 2. That is, when the loading motor 29 is run into rotation, the disc tray 2 is moved in the fore-and-aft direction as shown by arrow C in Fig. 1. The disc tray 2 is moved between the loading position shown in Figs. 1 and 9 and the unloading position shown in Figs. 1 and 11. The loading position is the position in which the disc tray 2 is positioned on the chassis 1, in other words, the disc drive unit 4 is faced by the discs 210, 202. The unloading position, on the other hand, is the position in which the disc tray 2 is protruded towards the forward side of the chassis 1, that is the disc tray 2 is protruded out of the slit aperture 75, as shown in Fig. 2. When in the unloading position, the disc tray 2 is protruded towards the front side of the front panel section 70 via the slit aperture 75, as shown in Fig. 1.

The rear side of the disc tray 2 has a cut-out 44 dimensioned to permit the movable frame 37 of the disc drive unit 4 to be passed therethrough. The cut-out 44 is formed so that, when the disc tray 2 is in the loading position, the cut-out 44 is located on the locus of rotational movement of the movable frame 37.

A substantially disc-shaped rotary table 3 is arranged on the disc tray 2. The rotary table 3 is fitted in a columnar-shaped recess 43 formed on the upper surface of the disc tray 2 and is adapted to be rotated about a supporting shaft 50 formed at the center on the bottom of the recess 43 by having a center region of the lower surface thereof supported by the shaft 50.

The rotary table 3 is rotated by a table driving motor 45 mounted on the bottom of the recess 43. That is, the table driving motor 45 rotates a follower pulley 48 rotatable mounted on the disc tray 2 and a driving gear 49

formed integrally with the follower pulley 48 via a driving pulley 46 mounted on a driving shaft and an endless driving belt 47 placed around the driving pulley 46. The lower surface of the rotary table 3 carries a gear meshing with a table driving gear 49.

The rotary table is formed with plural large-size disc setting recesses 54 and plural small-size disc setting recesses 53. Each large-size disc setting recess 54 is circular-shaped with an inner diameter equal to the diameter of the large-sized disc 201. These large-size disc setting recesses 54 are arranged at equiangular positions on the circumference of a circle having the center of rotation of the rotary table 3 as its center. Each small-size disc setting recess 54 is circular-shaped and has an inner diameter equal to the diameter of the large-sized disc 202.

The rotary table 3 has cut-outs 52 in association with the large size disc setting recesses 54. The cut-outs are formed for extending from the center of the large-size disc setting recesses 54 associated therewith up to the outer periphery of the rotary table 3. The cut-outs 52 are arrayed radially and opened on the outer periphery of the rotary table 3. The cut-outs 52 are dimensioned to admit part of the disc table 40 and the optical pickup unit 41.

A disc detection unit is mounted on the bottom surface of the small-sized disc setting surface 53 for detecting whether or not the large-sized disc 201 or the small-sized disc 202 is set on the large-size disc setting recesses 54 or on the small-size disc setting recesses 53 associated therewith. The disc detection device may be a so-called light sensor made up of a light-emitting device and a light-receiving device. The results of detection by the disc detection device are routed to an associated control circuit.

The rotational angular position of the rotary table 3 on the disc tray 2 is detected by a sensor provided

on the disc tray 2. If five sets of the disc setting
recesses 54, 53 are provided on the rotary table 3, the
rotary table 3 is provided with indices for indicating at
which of the five rotational angular positions of 0°, 72°,
5 144°, 216° and 288° the rotary table 3 is positioned. It is
these indices that are detected by the sensor.

When the disc tray 2 is at the loading position
and the movable frame 37 is at the release position, the
large-sized disc 201 or the small-sized disc 202 set on the
10 disc setting recesses 53, 54 positioned above the cut-out 44
of the disc tray 2 is held between the arm section 35 and
the pickup block 38 of the disc drive unit 4. When the
movable frame 37 is rotated at this time up to the chucking
position, the disc table 40 is intruded into the cut-out 52
15 so that the large-sized disc 201 or the small-sized disc 202
is chucked by having its center region clamped between the
disc table 40 and the chucking plate 36. The discs 201, 202
thus chucked is maintained at a position of being slightly
lifted out of contact with the rotary table 3.

20 It is noted that, when the disc tray 2 is at the
loading position and the movable frame 37 is at the release
position, the rotary table 3 is run in rotation by the
driving motor 45.

When the disc tray is at the unloading position,
25 the rotary table 3 is enabled to be rotated by the table
driving motor 45. The rotary table 3 is rotated at this
time for sequentially feeding the disc setting recesses 53,
54 protruded ahead of the front panel 70 in order to permit
the large-sized disc 201 or the small-sized disc 202 to be
30 set on the disc setting recesses 53, 54 or to permit the
large-sized disc 201 or the small-sized disc 202 set on the
disc setting recesses 53, 54 to be exchanged with new discs.

On each lateral side of the disc tray 2 are
provided a pair of suppressors 76 for preventing the
35 occurrence of the resonant oscillations of the disc tray.

These suppressors are formed as grove-shaped recesses extending in the fore-and-aft direction on each lateral side of the disc tray 2, as shown in Fig. 6. A first cam 81, a second cam 79 and a third cam 82 are formed in the

5 groove-shaped recess. The first cam 81 and the second cam 79 are continuously formed as ribs extending along the lower edge of the groove-shaped recess from the forward side towards the rear side of the disc tray 2. A supporting

10 groove 100 is defined between the rib playing the role of the first and second cams 81, 79 and the lower edge of the groove-shaped recess. The upper edge of the first cam 81 is parallel to and spaced apart a first pre-set distance from the lower edge of the groove-shaped recess. The upper edge

15 of the second cam 79 is parallel to and spaced apart from the lower edge of the groove-shaped recess a second distance smaller than the first pre-set distance. The upper edges of the first and second cams 81, 79 are merged into each other via inclined sections. The rear end of the second cam 79 becomes an inclined section 80 inclined towards the rear.

20 The third cam 82 is formed as a rib formed within the groove-shaped recess for extending along the lower edge of the groove-shaped recess from the rear end towards the forward side of the disc tray 2. The upper edge of the third cam 82 is parallel to and spaced apart via a first

25 pre-set distance from the lower edge of the groove-shaped recess.

On both lateral sides of the chassis 1 are mounted a forward side pair of rolls 83 and a rear side pair of rolls 84 as columnar-shaped rotating members constituting

30 suppression means along with the suppressors 76. These rolls 83, 84 are mounted on left side and right side supporting plates 12 acting as supporting members. In Fig. 3, only one supporting plate 12 is shown. The supporting plates 12 are mounted on the block 8 and on the supporting

35 block 9 for movement in the vertical direction, that is in a

direction towards and away from the chassis 1. That is, the supporting plates 12 are mounted facing each other so as to be perpendicular to the chassis 1 and parallel to the lateral side edge of the chassis 1. Each supporting plate 12 has supporting slits 88, 89, 90 and 91 each having the long-axis direction as its longitudinal direction, as shown in Fig. 13. Each supporting plate 12 is supported by support pawls 14, 15, 16 and 17 protuberantly formed on the outer surfaces of the blocks 8 and 9 by being engaged in these supporting slits 88, 89, 90 and 91. The rolls 83, 84 are mounted on the facing inner lateral sides of the supporting plates 12 in the fore-aft direction. These rolls 83, 84 are rotatable mounted with a pivot supporting shaft perpendicular to the supporting plate 12 as the center of rotation.

Each supporting plate 12 is biased in a direction of approaching the chassis 1, that is towards the lower side, by compression coil springs 92, 93 as biasing means, as indicated by arrow D in Figs. 5 to 8. These compression springs 92, 93 are interposed with slight compression between a tongue 101 formed by bending the lower edge of the supporting plate 12 and a flange 102 formed on the upper edge of each block 8 or 9. Each supporting plate 12 is positioned at the initial position by the supporting pawls 14 to 17 abutting on the upper edges of the supporting slits 88 to 91, respectively.

The rolls 83, 84 of the supporting plates 12 are intruded into the groove-shaped recesses constituting the tray tightening sections 76 from both sides of the disc tray 2, as shown in Fig. 5. When the disc tray 2 is at the loading position, the rolls 83, 84 are thrust upwards, against the bias of the compression coil springs 92, 93, so as to follow the first and the second cams 81, 79, for thrusting and supporting the disc tray 2 downwards, as shown in Fig. 6. When the disc tray 2 is at the unloading

position, the rear roll 84 is thrust upwards, against the bias of the compression coil springs 92, 93, so as to follow the third cam 82, for thrusting and supporting the disc tray 2 downwards. When the disc tray 2 is intermediate between the loading position and the unloading position, the rolls 83, 84 are out of contact with the cams 81, 79 and 82, so as to set the supporting plate 12 to its initial position, without thrusting the disc tray 2, as shown in Fig. 8.

A tray guide plate 13 is mounted on the supporting block 9, as shown in Figs. 4 and 13. The tray guide plate 13 is mounted on the support block 12 in superposition on the supporting plate 12 by plural set screws 18, 19 and 20. The supporting plate 12 has vertically elongated through-slits 94, 95 and 96 into which are passed set screws 18, 19 and 20. The tray guide plate 13 has its upper end bent towards the inner lateral side to form a guide section 87 which is intruded towards the disc tray 2 via a through-hole 86 formed in the supporting plate 12 so as to be intruded into the supporting groove 100 and positioned in the vicinity of the lower edge of the groove-shaped recess in the suppressor 76. The guide section 87 suppresses the movement of the disc tray 2 in an upward direction, that is in a direction away from the chassis 1.

On the lower surface of the disc tray 2, there are rotatable mounted first and second interrupted gears 56, 57, as tray locking means, as shown in Fig. 3 and Figs. 9 to 11. These interrupted gears 56 and 57 are substantially disc-shaped and formed on the outer peripheries thereof with gear teeth 60, 97, extending over a pre-set angular range, as shown in Fig. 12. Each of the interrupted gears 56 and 57 has a set of arcuate supporting slits 99, 99, 99. The interrupted gears 56 and 57 are rotatable supported by having depending supporting pins 111, 111, 111, 113, 113, 113 passed through the supporting slits 99, 99, 99.

The first interrupted gear 56 is mounted so that the gear teeth 60 form a continuing portion of the forward side end of a rack gear 114, that is, the first interrupted gear 56 is mounted with a point spaced apart from the forward side end of the rack gear 114 in a direction perpendicular to the rack gear 114 a distance equal to the radius of the first interrupted gear 56 as a center of rotation. In an initial state of the first interrupted gear 56, shown in Fig. 10, the first interrupted gear 56 is rotationally biased by a torsion coil spring 58 having its coil part wound about a support shaft 115 of the first interrupted gear 56 in a direction of forwardly moving the gear part 60 towards the forward side of the disc tray 2, as shown by arrow J in Fig. 10. The torsion coil spring 58 has one of its arms retained by a retention pin 109 formed on the lower surface of the disc tray 2, while having its other arm retained by a retention protrusion 110 formed on the lower surface of the first interrupted gear 56. In this initial position, the first interrupted gear 56 is positioned at an initial rotational position, with a positioning protrusion 59 on its outer periphery abutted against the retention pin 109. The gear teeth 60 are extended at this time towards the forward side of the rack gear 114 for forming a continuing portion of the rack gear 114.

The first interrupted gear 56 has a locking groove 112 on its lower surface. The locking groove 112 is formed as an arc having the center of rotation of the first interrupted gear 56 as its center and having its backwardly directed side opened when the first interrupted gear 56 is at the initial rotational position.

When the disc tray is moved to the loading position, with the forward side end of the rack gear 114 being disengaged towards the rear side of the loading gear 32, the first interrupted gear 56 has its gear teeth 60

engaged with the loading gear 32, and is rotated against the bias of the torsion coil spring 58 in a direction shown by arrow I in Fig. 9. The locking groove 112 is engaged at this time by a locking pin 116 formed on the chassis 1 in the vicinity of the loading gear 32. With the locking groove engaged in this manner by the locking pin 116, the disc tray 2 is unable to be moved in the fore-and-aft direction.

If, with the locking groove 112 engaged by the locking pin 116, the loading gear 32 is rotated in the direction of moving the disc tray 2 in the forward direction, the first interrupted gear 56 is rotated by the loading gear 32 and thereby returned to its initial rotational position for disengaging the locking groove 112 from the locking pin 116. The disc tray 2 is moved forwards after the first interrupted gear 56 is returned to the initial rotational position.

The second interrupted gear 57 is mounted so that its gear teeth 97 form a continuing portion of the rear side end of the rack gear 114, that is, the second interrupted gear 57 is mounted with a point spaced apart from the rear side end of the rack gear 114 in a direction perpendicular to the rack gear 114 a distance equal to the radius of the second interrupted gear 57 as a center of rotation. In an initial state of the second interrupted gear 57, shown in Fig. 10, the second interrupted gear 57 is rotationally biased by a torsion coil spring 63 having its coil part wound about a support shaft 106 of the second interrupted gear 57 in a direction of backwardly moving the gear teeth 97 towards the rear side of the disc tray 2, as shown by arrow K in Fig. 10. The torsion coil spring 63 has one of its arms retained by a retention pin 107 formed on the lower surface of the disc tray 2. The torsion coil spring has its other arm retained by a retention protrusion 108 formed on the lower surface of the second interrupted gear 57. In this

initial position, the second interrupted gear 57 is positioned at an initial rotational position, with a positioning protrusion 61 on its outer periphery abutted against the retention pin 107. The gear part 60 is extended
5 at this time towards the rear side of the rack gear 114 for forming a continuing portion of the rack gear 114.

The second interrupted gear 57 has a locking groove 98 on its lower surface. The locking groove 98 is formed as an arc having the center of rotation of the second
10 interrupted gear 57 as its center and having its backwardly directed side opened when the second interrupted gear 57 is at the initial rotational position.

When the disc tray is moved to the unloading position, with the rear side end of the rack gear 114 being
15 disengaged towards the forward side of the loading gear 32, the second interrupted gear 57 has its gear part 97 engaged with the loading gear 32, and is rotated against the bias of the torsion coil spring 63 in a direction shown by arrow L in Fig. 11. The locking groove 98 is engaged at this time
20 by the locking pin 116. With the locking groove engaged in this manner by the locking pin 116, the disc tray 2 is unable to be moved in the fore-and-aft direction.

If, with the locking groove 98 engaged by the locking pin 116, the loading gear 32 is rotated in the
25 direction of moving the disc tray 2 towards the rear, the second interrupted gear 57 is rotated by the loading gear 32 and thereby returned to its initial rotational position for disengaging the locking groove 98 from the locking pin 116. The disc tray 2 is moved backwards after the second
30 interrupted gear 57 is returned to the initial rotational position.

The locking pin 116 is mounted on a straight line interconnecting the center of rotation of the interrupted gear 56 and that of the interrupted gear 57.

On the lower surface of the disc tray 2 is rotatable mounted a table lock lever 64 as table lock means. The table lock lever 64 is rotatable supported by a supporting shaft 105 provided on the lower surface of the disc tray 2 and is arranged at back of the second interrupted gear 57. The table lock lever 64 has on its forward end a table lock pin 67 which may be intruded into and receded out of a recess 43 in the disc tray 2 via a through-hole 51 formed in the recess 43 as a result of rotation of the table lock lever 64. In the initial state, the table lock lever 64 is positioned by being rotationally biased for intruding the table lock pin 67 into the recess 43 via the through-hole 51 by a tension coil spring 65 mounted between a retention hole 104 formed towards the rear end of the table lock lever and a retention pin 103 provided near the rear end of the disc tray 2, as shown in Fig. 10.

When the table lock lever 64 is positioned at the initial position, the table lock pin 67 is engaged into one of plural lock recesses 55 formed on the peripheral surface of the rotary table 3 in order to obstruct the rotation of the rotary table 3. The lock recesses 55 are formed in register with disc setting recesses 54, 53 and formed equiangularly on the peripheral surface of the rotary table 3, with the number of the lock recesses 55 being thus equal to the number of the sets of the recesses 54 and 53. The rotary table 3, disabled to be rotated by the table lock pin 67, is positioned for causing a selected one of the sets of the disc setting recesses 54, 53 and the associated cut-out 52 to be aligned with the cut-out 44 in the disc tray 2.

When the disc tray 2 is at the loading position, the table lock lever 64 is rotated against the bias of the tension coil spring 65 in a direction indicated by arrow H in Fig. 9 by abutment of a first actuating pin 66 near its rear end against an actuating lug 28 formed on the rear side of the chassis for receding the table lock pin 67 out of the

recess 44 of the disc tray 2, as shown in Fig. 9. By the table lock pin 67 thus being receded from the recess 44 of the disc tray 2, the rotary table 3 may now be rotated with respect to the disc tray 2.

5 When the disc tray 2 reaches the unloading position and the second interrupted gear 57 is rotated, the table lock lever 64 has a second actuating pin 68 at its forward end being abutted against an actuating protrusion 62 formed on the outer periphery of the second interrupted gear 10 57, as shown in Fig. 11. Thus the table lock lever 64 is rotated against the bias of the tension coil spring 65 for receding the table lock pin 67 out of the recess 44 of the disc tray 2. The rotary table 3 may now be rotated relative to the disc tray 2.

15 In the initial state before start of use of the above-described disc recording and/or reproducing apparatus, the disc tray 2 is at the loading position, with the large-sized disc 201 or the small-sized disc 202 being not set on the rotary table 3, as shown in Figs. 2, 6 and 9.

20 For setting the large-sized disc 201 or the small-sized disc 202 on the disc recording and/or reproducing apparatus, an actuating member 73 is actuated for moving the disc tray 2 forwardly as shown by arrow G in Figs. 7 and 11 for shifting the disc tray 2 to the unloading 25 position as shown in Figs. 3, 7 and 11. During the movement of the disc tray 2 to the unloading position, the rotation of the rotary table 3 is inhibited by the table lock lever 64, as shown in Fig. 10.

30 When the disc tray 2 is at the unloading position, the forward half portion of the disc tray 2 is protruded beyond the front panel section 70. The disc tray 2 has the third cam 82 thrust and supported by the roll 84 and is thereby disabled to perform oscillatory movements. The rotary table 3 is enabled at this time to be rotated by a 35 table drive motor 45. By rotation of the rotary table 3,

the large-sized disc 201 or the small-sized disc 202 may sequentially be set on the disc setting recesses 54, 53. When in the unloading position, the disc tray 2 is locked in the unloading position by the lock groove 98 in the second interrupted gear 57 being engaged by the lock pin 116. The
5 movable frame 37 of the disc drive unit 4 is at the release position.

For recording or reproducing the information signals on or from the disc 201, 202 set on the rotary table
10 3, the disc tray 2 is moved towards rear as indicated by arrow F in Figs. 8 and 10 for moving the disc tray 2 to the loading position as shown in Figs. 2, 6 and 9. During the movement of the disc tray 2, rotation of the rotary table 3 is inhibited by the table lock lever 64, as shown in Fig.
15 10. At this time, there is no risk of the rotary table 3 being rotated under an external force.

When in the loading position, the disc tray 2 has the first and the second cams 81, 79 thrust and supported by the rolls 83, 84 and is disabled to perform oscillatory
20 movements. The rotary table 3 is enabled to be rotated by the table lock lever 64 being rotated by the actuating lug 28. The rotary table 3 is rotated at this time by the actuating member 73 for selecting one of the recording discs 201, 202 as set on the rotary table 73 and transporting the
25 selected disc to a position in register with the disc drive unit 4. The movable frame 37 then is moved to the chucking position for chucking the selected disc 201 or 202 on the disc table 40.

The discs 201, 202, thus chucked on the disc table
30 40, is run in rotation at, for example, a constant linear velocity (CLV) by a spindle motor for reading or recording information signals by the optical pickup device 41. Should oscillatory movements be produced during rotation of the disc 201 or 202, the disc tray 2 is not driven into resonant

oscillations because the disc tray 2 is prevented from minute movements or oscillations by the rolls 83, 84.

Also, with the present disc recording and/or reproducing apparatus, the disc tray 2 may be moved to its unloading position when the first discs 201 or 202, for example, are loaded on the disc table 40. At this time, the large-sized disc 201 or the small-sized disc 202 may be set on the second to fifth recesses 54, 53 or the discs set thereon may be exchanged with new ones. These setting and exchanging operations may be performed while rotating the rotary table 3.

If, with the present disc recording and/or reproducing apparatus, the disc tray 2 is moved to the unloading position when the first discs 201, 202 have been loaded on the disc table 40, the disc tray 2 may be returned to the loading position on the condition that there are no other discs 201, 202 set on the first disc-setting recesses 54, 53 in which the first discs 201, 202 were set, and that the rotational angular position of the rotary table 3 is such that the first disc setting recesses 54, 53 are at a rear position facing the disc drive unit 4. The possible presence of the discs 201, 202 on the first disc setting recesses 54, 53 or the rotational angular position of the rotary table 3 may be discriminated by the control circuit based upon the results of detection by the disc detection device and the sensor designed to detect the rotational angular position of the rotary table 3.

If, with the present disc recording and/or reproducing apparatus, the power supply is interrupted when a disc 201 or 202 is loaded on the disc table 40 and the disc tray 2 is moved towards the unloading position, there is the risk of the rotary table 3 being rotated under the external force. However, the disc tray 2 is not moved under the external force. Consequently, there is no risk of the disc tray 2 being moved backwards whilst the other discs

201, 202 remain set on the disc setting recesses 54, 53 disposed towards the rear for facing the disc drive unit 4. When the power supply is re-started, the control circuit is again in operation in order to check for the conditions that
5 there are no other discs 201, 202 set on the first disc setting recesses 54, 53 on which the discs 201, 202 loaded on the disc drive unit 4 were set and that the rotational angular position of the rotary table 3 is such that the first disc setting recesses 54, 53 are disposed at the rear
10 position. Consequently, the disc tray 2 is not moved backwards unless these conditions are met.

The discs 201, 202 loaded on the disc table 40 are set on the disc setting recesses 54, 53 on which these discs were set as a result of the movable frame 37 being moved to
15 the release position when the disc tray 2 is at the loading position. Under this condition, selection of the discs may be made by rotating the rotary table 3. That is, by rotating the rotary table 3 for moving the movable frame 37 to its chucking position, other discs 201, 202 may be loaded
20 on the disc table 40. The disc tray 2 may be moved at this time to the unloading position for taking out the discs 202, 201 out of the disc recording and/or reproducing apparatus.

CLAIMS

1. A disc recording and/or reproducing apparatus
5 comprising:

recording/reproducing means for
recording/reproducing information signals on or from a disc
mounted in a main body of the apparatus;

10 a transporting tray mounted for movement between a
loading position facing said recording/reproducing means
provided within said main body of the apparatus and an
unloading position outside of said main body of the
apparatus;

15 driving means for moving said transporting tray
between the loading position and the unloading position;

a rotary table rotatable mounted on said
transporting tray, said rotary table having plural
disc-setting recesses extending radially from the center of
rotation thereof, said rotary table when rotated relative to
20 said transporting tray selectively moving one of said disc
setting recesses to a position facing said
recording/reproducing means;

first lock means provided on said transporting
tray and adapted for being engaged with said rotary table
25 for obstructing the rotation of said rotary table with
respect to said transporting tray, said first lock means
obstructing the rotation of the rotary table when said
transporting tray is not positioned at said unloading
position; and

30 second lock means operated by said driving means
for obstructing the movement of said transporting tray, said
second lock means being actuated by said driving means for
obstructing the movement of said transporting tray when the
transporting tray reaches said unloading position.

2. A disc recording and/or reproducing apparatus according to claim 1, wherein a lock part is provided in the main body of the apparatus and wherein said second lock means has a first rotary member engaged with said lock part at said loading position for suppressing the movement of the transporting tray and a second rotary member engaged with said locking part at said unloading position for suppressing the movement of the transporting tray, said first and second rotary members being provided in said transporting tray, said first rotary member and the second rotary member being run in rotation by said driving means when the transporting tray reaches said loading position or said unloading position.
3. A disc recording and/or reproducing apparatus according to claim 1, wherein said driving means has a driving gear engaged with a rack formed on said transporting tray for moving said transporting tray, and wherein said first rotary member and the second rotary member are formed with gears meshing with said driving gear.
4. A disc recording and/or reproducing apparatus as according to claim 2, wherein said first rotary member and the second rotary member are provided on said transporting tray along the locus of movement of said transporting tray.
5. A disc recording and/or reproducing apparatus according to claim 1, 2, 3 or 4 wherein said first lock means has a lock member rotatable mounted on said transporting tray and adapted for being engaged with said rotary table, said lock member being disengaged from said rotary table by an actuating member when the transporting tray is at said loading position, said lock member being disengaged from said rotary table by said lock means when the transporting tray is at said unloading position.

6. A disc recording and/or reproducing apparatus according to any one of the preceding claims, said apparatus further comprises suppression means for inhibiting oscillating movement of said transporting tray at said loading position or at said unloading position.

7. A disc recording and/or reproducing apparatus according to claim 6, wherein said suppression means has a cam provided on said transporting tray, a rotating member rotatable mounted in the main body of the apparatus for having a rolling contact with said cam and thrusting means for thrusting said rotating member in the direction of being abutted against said cam.

8. A disc recording and/or reproducing apparatus comprising:

recording/reproducing means for recording/reproducing information signals on or from a disc mounted in a main body of the apparatus;

a transporting tray mounted for movement between a loading position facing said recording/reproducing means provided within said main body of the apparatus and an unloading position outside of said main body of the apparatus;

driving means for moving said transporting tray between the loading position and the unloading position; and

suppression means for inhibiting oscillations of said transporting tray at said loading position or at said unloading position.

9. A disc recording and/or reproducing apparatus according to claim 8, wherein said suppression means has a cam provided on said transporting tray, a rotating member rotatable mounted on said main body of the apparatus for having a rolling contact with said cam and thrusting means

for thrusting said rotating member in the direction of being abutted against said cam.

10. A disc recording and/or reproducing apparatus
5 according to claim 9, wherein said cam has a protrusion at the loading position and at the unloading position of said transporting tray.
11. A disc recording and/or reproducing apparatus
10 according to claim 8, 9 or 10, said apparatus further comprises guide means for guiding said transporting tray between the loading position and the unloading position, said suppression means being provided in said guide means.
12. A disc recording and/or reproducing apparatus
15 according to claim 11, wherein said transporting tray has a cam groove along the direction of movement of said transporting tray and said guide means having a rotating member for having a rolling contact with the inner surface
20 of said cam groove.
13. A disc recording and/or reproducing apparatus
25 according to claim 12, wherein said suppression means include plural protrusions formed on said cam in register with the loading position and the unloading position of said transporting tray for being protruded towards the inner side of said groove and thrusting means for thrusting said rotating member against said protrusions when the transporting tray is at said loading position or at said
30 unloading position.
14. A disc recording and/or reproducing apparatus
35 according to any one of claims 8 to 13, said apparatus further comprises lock means actuated by said driving means for inhibiting movement of said transporting tray, said lock

means being actuated by said driving means when said transporting tray reaches said unloading position for obstructing the movement of the transporting tray.

- 5 15. A disc recording and/or reproducing apparatus constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Patents Act 1977**Examiner's report to the Comptroller under Section 17
(The Search report)**Application number
GB 9407675.9**Relevant Technical Fields**

(i) UK Cl (Ed.M) G5R (RPC2, RPC4, RB73)

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Search Examiner
PETER SLATERDate of completion of Search
8 JUNE 1994**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES: WPI

Documents considered relevant
following a search in respect of
Claims :-
1-7**Categories of documents**

- X:** Document indicating lack of novelty or of inventive step. **P:** Document published on or after the declared priority date but before the filing date of the present application.
- Y:** Document indicating lack of inventive step if combined with one or more other documents of the same category. **E:** Patent document published on or after, but with priority date earlier than, the filing date of the present application.
- A:** Document indicating technological background and/or state of the art. **&:** Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2187877 A (SONY) see page 3 lines 69-73	1
A	US 5193079 A (INKEL CORP) see column 3 lines 5-14	1
A	US 5123005 A (SONY)	1
A	US 5115419 A (YAMAHA) see column 6 lines 27-34	1

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